



Make a Comet and Eat It!

DESCRIPTION

In this activity students develop a comet model that can be eaten and trade another “comet” on which to take measurement using four senses.

OBJECTIVES

Students will

- Investigate the physical characteristics of comets
- Compare their ideas about comets with the data that NASA comet missions have sent back to Earth
- Develop a comet model

NASA SUMMER OF INNOVATION UNIT

Earth and Space Science—Year of the Solar System

GRADE LEVELS

4 – 6

CONNECTION TO CURRICULUM

Science and Technology

TEACHER PREPARATION TIME

2 hours

LESSON TIME NEEDED

1.5 hours Complexity: Moderate

NATIONAL STANDARDS

National Science Education Standards

Science As Inquiry

- Understanding of scientific concepts
- An appreciation of "how we know" what we know in science.

Physical Science Standards

- Properties of objects and materials

Earth and Space Science Standards

- Objects in the Sky

Science and Technology

- Abilities to distinguish between natural objects and objects made by humans

ISTE NETS and Performance Indicators for Students

Communication and Collaboration

- Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media
- Contribute to project teams to produce original works or solve problems

MANAGEMENT

Materials need to be purchased fresh and kept in containers. Anything that is used to measure, hold, or eat with or out of should not have been previously used for any classroom chemical storage.

A mop and sponge is helpful for desks or floor areas where measuring is done. Consider preloading ice cream bags and salt bags at home.

The ice needs to be either freshly made or frozen in storage. The container for transporting and storing the ice should be precooled if possible or very efficient. If the ice has “warmed,” it will be difficult to get the milk/cream to solidify.

CONTENT RESEARCH

- Comets are in orbit around the Sun as are our planets.
- Comets are composed of ice, dust, and rocky debris carried from the early formation of the solar system about 4.5 billion years ago.
- Comets are remnants from the cold outer regions of the solar system. They are generally thought to come from two areas: the Oort Cloud and the Kuiper Belt. Both of these are areas where materials left over from the formation of our solar system have condensed into icy objects. Both regions extend beyond the orbits of Neptune and Pluto but are still part of our solar system and much closer to us than the closest star.
- Comet orbits are elliptical; they orbit close and then far away to the Sun.
- Short-period comets orbit the Sun every 20 years or less. Long-period comets orbit the Sun every 200 years or longer. Those comets with orbits between 20 and 200 years are called Halley-type comets.
- Comets have three parts: the nucleus, coma, and tails. The nucleus is the solid center component made of ice, gas, and rocky debris. The coma is the gas and dust atmosphere around the nucleus, which results when heat from the Sun warms the surface of the nucleus so that gas and dust spew forth in all directions and are driven from the comet's surface. The tails are formed when energy from the Sun turns the coma so that it flows around the nucleus and forms a fanned out tail behind it extending millions of miles through space.
- A comet's coma and tail can be seen because sunlight reflects off the dust (in the coma and dust tail) and because the energy from the Sun excites some molecules so that they glow and form a bluish tail called an ion tail and a yellow one made of neutral sodium atoms.
- Scientists have seen comets range in size from less than 1 km diameter to as much as 300 km, although the 300 km (called Chiron) does not travel into the inner solar system.
- Because a comet could impact Earth, it is important to understand the nature of comets so we can design better methods to protect ourselves from them should one be on a collision path with Earth.
- A comet nucleus has a dark, sometimes mottled surface but we do not know if it has an outer crust or if it is layered inside. We do not really know what comets are like beneath their surface, which is why we need a mission like Deep Impact.

LESSON ACTIVITIES

Comet on a Stick

In this activity, you are going to develop a comet model that you can eat. The students will trade “comets” and pretend to be an instrument on the Deep Impact Spacecraft called a spectrometer. You will use four of your senses individually to decide what is in the ice cream.

<http://solarsystem.nasa.gov/deepimpact/educ/IceCream02.html>

ADDITIONAL RESOURCES

- Consider This: This page shows the history of perceptions about comets.
<http://deepimpact.umd.edu/educ/ExploringComets03.html>
- A Comet’s Place in the Solar System: This page gives a little history about where comets originate
<http://deepimpact.umd.edu/educ/ExploringComets04.html>
- Small Bodies Missions: Information about Deep Impact and other missions to comets
<http://deepimpact.umd.edu/science/smallbodies.html>
- C-O-M-E-T-S—A Comet Acrostic: Good for younger students or as a quick reference
<http://solarsystem.nasa.gov/deepimpact/educ/CometAcrostic.html>

DISCUSSION QUESTIONS

- What do you know about comets? *Answers will vary.*
- What comets have been visited by spacecraft, and what information about the comets did those spacecraft send back to Earth?: *Comet Wild 2, Comet Temple 1, Comet Hartley 2, Comet Borrelly, Halley’s Comet, Comet Giacobini-Zinner, Comet 2006P1, and Comet Hartley. We now know much more about the shape of the nucleus of some comets, the chemical composition of the nucleus and tail, and the rotation period of the nucleus, among other things.*
- Have you ever seen a comet? *Answers will vary.*

ASSESSMENT ACTIVITIES

After students finish making a comet, ask them to complete the Student Research Data Sheet

<http://solarsystem.nasa.gov/deepimpact/educ/IceCream03.html>

Instruct them to answer the following questions:

MATERIALS

- One sandwich size reclosable plastic bag per teams of 2 to 4
- One Gallon size reclosable plastic bag per teams of 2 to 4
- Small cups for ice cream—one for each person on the team. Two additional cups are needed to trade with another team—one each to feel only, taste, smell, and see.
- Plastic spoons—one per student
- Rubber kitchen gloves, oven mitts, or cloths or sweaters (The comet bags get cold!)
- Ice (to fill a gallon-size bag half full per team) or fresh snow
- Chunky cookies in black or brown, crushed candies (like toffee or peppermint), gummy bears, coconut flakes, or peanuts
- Whole milk (2% won't work)
- Sugar
- Vanilla extract
- Evaporated milk
- Salt
- Can opener
- Something to use to crush cookies and other additives

- What visual observations do you make about your ice cream comet? Diagrams can be drawn also. *Answers will vary.*
- What are you able to tell by using your fingers (do not taste) to touch the “feel only” ice cream comet? *Answers will vary.*
- What are you able to tell about your sample comet using only your sense of smell? *Answers will vary.*
- What are you able to tell about your sample comet adding your sense of taste? *Answers will vary.*
- What explanations do you draw about the composition of your comet? *Answers will vary.*

ENRICHMENT

- **Comparing Comets:**
In this activity, participants will play the role of a cometary scientist, observing and comparing the surfaces of two comet nuclei from close range.
http://epoxi.umd.edu/pdfs/Comparing_Comets_SA.pdf
- **Comet Lingo Bingo:**
Students read The Comet Chronicle—a fun comet tabloid written to provide basic understanding of comet science and a background of NASA’s past and ongoing explorations of comets.
<http://epoxi.umd.edu/4education/index.shtml>
- **Comet Gallery:**
A nice collection of pictures and videos from the NASA comet Deep Impact mission.
<http://solarsystem.nasa.gov/deepimpact/gallery/index.cfm>
- **Deep Impact Ed. Page:**
Lots of puzzles, games, and more activities dealing with comets.
<http://solarsystem.nasa.gov/deepimpact/educ/index.cfm>